

WE CLAIM:

1. A method of removing etch residue from a substrate, the method comprising:
 - 5 providing a composition comprising:
 - at least one fluoride ion source comprising an organic cation;
 - and
 - at least one organic solvent;
 - 10 providing a substrate having etch residue on at least one surface; and
 - contacting the surface of the substrate having etch residue thereon with the composition under conditions effective to remove at least a portion of the etch residue.
2. The method of claim 1, wherein the step of contacting the surface of the substrate comprises immersing the substrate in the composition, spraying the surface of the substrate with the composition, or both the immersing and spraying steps.
3. The method of claim 1, wherein the substrate comprises a semiconductor substrate.
4. The method of claim 1, wherein the fluoride ion source includes F^- ions or HF_2^- ions.
5. The method of claim 1, wherein the fluoride ion source is present in the composition in an amount of no greater than about 0.01 wt-%.
6. The method of claim 5, wherein the fluoride ion source is present in the composition in an amount of no greater than about 0.1 wt-%.

7. The method of claim 6, wherein the fluoride ion source is present in the composition in an amount of no greater than about 0.5 wt-%.
8. The method of claim 1, wherein the fluoride ion source is present in the composition in an amount of no greater than about 1.0 wt-%.
9. The method of claim 1, wherein the composition includes no more than about 3 wt-% water.
10. The method of claim 1, wherein the fluoride ion source includes a cation selected from the group of an organoammonium cation, a pyridinium cation, a quaternary organophosphonium cation, a quaternary organoarsonium cation, a quaternary organostibonium cation, a triorganocarbonium cation, an organosulfonium cation.
11. The method of claim 10, wherein the fluoride ion source includes a quaternary ammonium fluoride.
12. A cleaning method in a semiconductor fabrication process, the method comprising:
- providing a semiconductor structure having an etch residue on at least a portion thereof;
 - providing a composition comprising:
 - at least one fluoride ion source comprising an organic cation;
 - and
 - at least one organic solvent; and
 - exposing the semiconductor structure to the composition to remove at least a portion of the etch residue.

13. The method of claim 12, wherein the exposing step includes exposing the semiconductor structure to the composition at a temperature of about 20°C to about 75°C.

5 14. The method of claim 12, wherein the fluoride ion source includes F⁻ ions or HF₂⁻ ions.

15. The method of claim 12, wherein the fluoride ion source is present in the composition in an amount of no greater than about 1.0 wt-%.

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16. The method of claim 12, wherein the composition includes no more than about 3 wt-% water.

15 17. The method of claim 12, wherein the fluoride ion source includes a cation selected from the group of an organoammonium cation, a pyridinium cation, a quaternary organophosphonium cation, a quaternary organoarsonium cation, a quaternary organostibonium cation, a triorganocarbonium cation, an organosulfonium cation.

20 18. The method of claim 12, wherein the etch residue comprises polymeric etch residue.

19. The method of claim 12, wherein the semiconductor structure comprises a via.

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20. The method of claim 19, wherein the etch residue is present on the sidewalls of the via.

21. A cleaning method in a semiconductor fabrication process, the method comprising:

providing a semiconductor structure having an etch residue on at least a portion thereof;

5 providing a composition comprising:

greater than about 1.0 wt-% of at least one fluoride ion source

comprising an organic cation; and

at least one organic solvent; and

10 exposing the semiconductor structure to the composition to remove at least a portion of the etch residue.

22. A cleaning method in a semiconductor fabrication process, the method comprising:

15 providing a semiconductor structure having an etch residue on at least a portion thereof;

providing a composition consisting essentially of:

at least one fluoride ion source comprising an organic cation;

and

at least one organic solvent; and

20 exposing the semiconductor structure to the composition to remove at least a portion of the etch residue.

23. A cleaning method in a semiconductor fabrication process, the method comprising:

25 providing a semiconductor structure having an etch residue on at least a portion thereof and comprising a layer comprising at least a portion of exposed metal;

providing a composition comprising:

at least one fluoride ion source comprising an organic cation;

30 and

at least one organic solvent; and

exposing the semiconductor structure to the composition to remove at least a portion of the etch residue and substantially none of the exposed metal.

5 24. The method of claims 23, wherein exposing the semiconductor structure is carried out at 40°C in an exposure time of no greater than about 5 minutes.

25. The method of claim 23, wherein the metal is aluminum.

10 26. A composition for use in integrated circuit fabrication, the composition consisting of:

greater than about 1.0 wt-% of at least one fluoride ion source
comprising an organic cation; and
at least one organic solvent.

27. A composition for use in integrated circuit fabrication, the composition comprising:

at least one fluoride ion source comprising an organic cation; and

at least one organic solvent,

5 wherein the composition includes no more than about 3 wt-% water.

28. The composition of claim 27 wherein the fluoride ion source includes F^- ions or HF_2^- ions.

10 29. The composition of claim 27 wherein the fluoride ion source includes a cation selected from the group consisting of an organoammonium cation, a pyridinium cation, a quaternary organophosphonium cation, a quaternary organoarsonium cation, a quaternary organostibonium cation, a triorganocarbonium cation, and an organosulfonium cation.

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30. The composition of claim 27 wherein the fluoride ion source includes a quaternary ammonium fluoride.

20 31. The composition of claim 27 wherein the composition is in contact with a substrate having an etch residue on at least one surface.

32. The composition of claim 31 wherein the etch residue comprises polymeric etch residue.

25 33. The composition of claim 31 wherein the composition is effective to remove at least a portion of the etch residue.

34. The composition of claim 27 wherein the composition is in contact with a semiconductor structure having an etch residue on at least one surface.

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35. The composition of claim 34 wherein the composition is effective to remove

at least a portion of the etch residue.

36. The composition of claim 27 wherein the composition is in contact with a semiconductor structure having an etch residue on at least a portion thereof and comprising a layer comprising at least a portion of exposed metal.

37. The composition of claim 36 wherein the composition is effective to remove at least a portion of the etch residue and substantially none of the exposed metal.

38. A composition for use in integrated circuit fabrication, the composition comprising:
at least one fluoride ion source comprising an organic cation; and
at least one organic solvent,
wherein the composition is free of water.

39. The composition of claim 38 wherein the fluoride ion source includes F^- ions or HF_2^- ions.

40. The composition of claim 38 wherein the fluoride ion source includes a cation selected from the group consisting of an organoammonium cation, a pyridinium cation, a quaternary organophosphonium cation, a quaternary organoarsonium cation, a quaternary organostibonium cation, a triorganocarbonium cation, and an organosulfonium cation.

41. The composition of claim 38 wherein the fluoride ion source includes a quaternary ammonium fluoride.

42. A composition for use in integrated circuit fabrication, the composition consisting essentially of:

at least one fluoride ion source comprising an organic cation; and
at least one organic solvent.

43. The composition of claim 42 wherein the fluoride ion source is present in the composition in an amount of no greater than about 1.0 wt-%.

5 44. The composition of claim 42 wherein the fluoride ion source is present in the composition in an amount of no greater than about 0.5 wt-%.

45. The composition of claim 42 wherein the fluoride ion source is present in the composition in an amount of no greater than about 0.1 wt-%.

10 46. The composition of claim 42 wherein the fluoride ion source is present in the composition in an amount of no greater than about 0.01 wt-%.

47. A composition for use in integrated circuit fabrication, the composition consisting of:
15 at least one fluoride ion source comprising an organic cation; and
at least one organic solvent.

48. The composition of claim 47 wherein the fluoride ion source includes F^- ions or HF_2^- ions.
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49. The composition of claim 47 wherein the fluoride ion source includes a cation selected from the group consisting of an organoammonium cation, a pyridinium cation, a quaternary organophosphonium cation, a quaternary organoarsonium cation, a quaternary organostibonium cation, a triorganocarbonium cation, and an organosulfonium cation.
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50. The composition of claim 47 wherein the fluoride ion source includes a quaternary ammonium fluoride.